

THE NEW COOPERATIVE MEDICAL SCHEME IN RURAL CHINA: DOES MORE COVERAGE MEAN MORE SERVICE AND BETTER HEALTH?

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SUMMARY

This paper explores the impact of the New Cooperative Medical Scheme (NCMS), a newly adopted public health insurance program in rural China. Using a longitudinal sample drawn from the China Health and Nutrition Survey (CHNS), we employed multiple estimation strategies (individual fixed-effect models, instrumental variable estimation, and difference-in-differences estimation with propensity score matching) to correct the potential selection bias. We find that participating in the NCMS significantly decreases the use of traditional Chinese folk doctors and increases the utilization of preventive care, particularly general physical examinations. However, we do not find that the NCMS decreases out-of-pocket expenditure nor do we find that it increases utilization of formal medical service or improves health status, as measured by self-reported health status and by sickness or injury in the past four weeks. Our study indicates that despite the wide expansion of coverage, the impact of the NCMS is still limited. Copyright © 2009 John Wiley & Sons, Ltd.

KEY WORDS: China; health reform

1. INTRODUCTION

The key issue in the current debate over China's recent health care reform is whether extending public health insurance coverage to the uninsured results in an improvement in their health. In 2003, China adopted a new health insurance system, the New Cooperative Medical Scheme (NCMS), in rural areas where 80% of people were without health insurance of any kind (Wagstaff *et al.*, 2009). Over time, the NCMS has expanded its coverage to include more counties. Beginning with only 310 out of China's 2861 rural counties in 2004 (Mao, 2005), its coverage had expanded to 2451 counties by the end of 2007, accounting for 86% of all rural counties in China (Wen, 2008).

While the rapid increase of health insurance coverage in rural China is certainly striking, it means little if the program's effectiveness is limited. It is possible that increased coverage may not result in increased utilization of care or improvement in health. Additionally, it is possible that the NCMS does not actually relieve individuals of the financial burden of health care by reducing out-of-pocket expenditures. This paper will shed light on the effectiveness of the NCMS by focusing on whether it leads to reduced financial burden, improved public health, and increased access to care.

This study utilizes the China Health and Nutrition Survey (CHNS), a nationwide longitudinal survey, to analyze the impact of the NCMS. In this paper, we attempt to identify the effects of the NCMS by looking at the dramatic expansion of the NCMS program for rural residents in the last few

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years. There is substantial variation across counties in NCMS inception dates. We used the date of county-level NCMS inception as an instrumental variable (IV) for an individual's NCMS health insurance status in order to identify the causal effect of the NCMS on health, on utilization of preventive care, formal medical care and traditional Chinese folk doctors, and on out-of-pocket expenditure. By using instruments that are arguably exogenous to insurance status, the potential omitted variable problems that bias ordinary least squares (OLS) and logit regression estimates are addressed. In addition to the IV method, we also used individual fixed-effects (FE) estimation and the difference-in-differences methodology with propensity score matching (DDPSM) to study the effects of the NCMS.

Employing these multiple identification strategies, we consistently find that while the NCMS has increased preventive-care utilization among rural people, there is no accompanied increase in medical facility utilization by the sick. There is also no sign that the NCMS decreases out-of-pocket spending for patients. Moreover, overall health status, as measured by self-reported health and incidence of sickness or injury in the four weeks prior to the time of interview, showed no improvement.

The following sections proceed as follows: Section 2 introduces background information on the NCMS, Section 3 provides a literature review, Section 4 describes the data, Section 5 explains estimation methods, and Section 6 provides estimation results. The final section concludes with policy implications.

2. BACKGROUND OF THE NCMS

2.1. Establishing the NCMS

The original Cooperative Medical Scheme (CMS) was first implemented in rural China in the 1950s (Yip *et al.*, 2008). It was organized at the village level and managed by the CMS Management Committee, consisting of village administration representatives and the village clinic. The CMS experienced dramatic development in its early years, and at its peak in 1978 it covered as many as 90% of rural residents (Liu and Cao, 1992). It is believed by many that the program helped to reduce China's mortality rate during the 1960s and 1970s (Sidel, 1993).

With the collapse of the collective economy in the early 1980s, most villages lost their collective welfare funds, which in turn resulted in the loss of the main source of financing for the CMS. As a result, counties began dropping the program and coverage rates fell sharply from 90% in 1980 to 5% in 1985 (Liu and Cao, 1992).

Despite various attempts to rebuild an insurance system, the majority of rural residents remained uninsured between 1985 and 2003. The coverage rate remained low throughout the 1990s, never exceeding 10%, though it did experience a small increase in the late 1990s (Yip and Hsiao, 2008). By 2003, the rate of coverage had increased to approximately 20% (Yip and Hsiao, 2008). Some studies have shown that lack of health insurance raised the number of rural households living below the poverty line by 44%, as low-income families had to cover high-out-of-pocket medical costs themselves (Center for Health Statistics and Information, 2004; Liu, 2004; Watts, 2006).

To solve the problem of this lack of health insurance among the rural population, the Chinese government launched the NCMS in 2003. At its inception, the NCMS aimed to provide health coverage for the nation's entire rural population by 2010 (State Council, 2002).¹ The 2002 State Council Policy Document No. 13, *Decisions of the State Council on Strengthening Rural Healthcare* (State Council, 2002), contains three specific guidelines for the design and implementation of the NCMS for each county to follow: (1) participation in the NCMS is voluntary; (2) the administration must come from the county level; and (3) the NCMS would focus on catastrophic illnesses, receiving funding from both

¹With the rapid expansion of the NCMS, this goal is now promised to be achieved by 2008 (Yip and Hsiao, 2008).

the government (central and local) and individuals. In addition, to reduce adverse selection, the NCMS also requires full household participation, with either all or none of the members in a family participating in the program.²

On the condition that a county government follows the aforementioned guidelines, it is allowed to design and implement its own programs according to its specific needs. Therefore, programs vary considerably across counties with respect to deductibles, copayments, premiums, and coverage.

2.2. Financing of the NCMS

Financing of the NCMS for the central and western provinces of China differs from that of the eastern provinces. At its inception in 2003, the central government subsidized the program in the central and western provinces at the rate of 10 RMB per enrollee, while the local governments and enrollees were required to contribute to the premium no less than 10 RMB in order to receive subsidies from the central government. For the relatively more affluent eastern provinces, the central government offered no subsidies, instead requiring that the local governments subsidize 20 RMB when their fiscal conditions allowed (Ministry of Health *et al.*, 2003).

In 2006, the central government increased its subsidies for enrollees in the central and western provinces to 20 RMB and required local governments to increase their subsidies by 10 RMB as well (China Ministry of Health *et al.*, 2006). In the 2008 Government Work Report, the government promised to raise the subsidies to 80 RMB per enrollee in the central and western provinces by 2010, with 40 RMB from the central government and the same amount from local governments. In the eastern provinces, it was not until 2006 that the central government started to issue subsidies equal to the value of those of the local governments, as it had done in the central and western provinces (China Ministry of Health and Ministry of Finance, 2008).

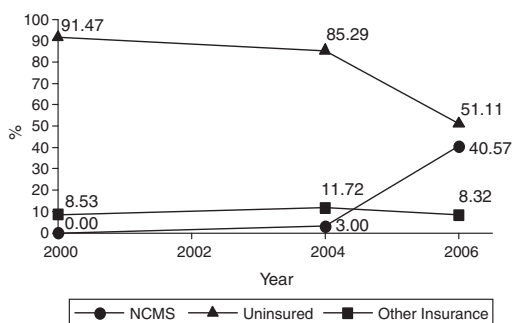
In 2005, the total financing (not including Tibet) for the NCMS was 10.903 billion RMB, of which 10.24% was from the central government and 47.44% was from local governments (News Office for Ministry of Health, 2006). In 2006, the number was increased to 21.359 billion RMB, of which 4.27 billion RMB was centrally subsidized. The remaining financing came from local governments and premium payments, amounting to 10.78 billion RMB and 5.8 billion RMB, respectively. In 2006, the amount of per capita financing averaged 51.88 RMB (not including Tibet), with 61.77 RMB per capita in the eastern provinces and 44.44 RMB per capita in the central and western provinces.

2.3. Coverage

As described in previous sections, the NCMS has witnessed a rapid expansion in coverage since its inception. The number of counties covered increased from 310 in 2004 to 2451 in 2007, with a total of 0.73 billion participants.

The rapid increase in NCMS coverage can also be found in the CHNS data used for this study. Figure 1 shows the percentage of insurance coverage for rural residents by insurance type over time using the CHNS data. The line indexed by circles indicates that coverage under NCMS, which did not begin until the founding of the program in 2003, has since increased dramatically. In 2004, 3% of rural residents were covered under the NCMS, and by 2006, this number had increased to 40.57%, with an accompanying decrease over time in the number of uninsured. In 2000, 91.47% of urban residences were without health insurance of any kind, but this figure decreased from 85.29% in 2004 to 51.11% in 2006.

²Despite this requirement, we find that partial-household participation does in fact exist, albeit constituting a small proportion. Our data show that among individuals in NCMS households (i.e. households with at least one member had enrolled in NCMS), 6.7% did not participate in NCMS in 2004. In 2006, this figure was approximately 7.9%, indicating that either the full-household participation requirement is not strictly adhered to, or some individuals erroneously reported their insurance status. We will discuss more about this issue later in the text.



Note: 1. Source: China Health and Nutrition Survey, 2000, 2004, 2006.
 2. Sample Universe: Individuals with an agriculture hukou and live in rural areas.
 3. Other Insurance includes old CMS, commercial insurance, free medical insurance, etc.

Figure 1. Percentage of insurance coverage

2.4. Reimbursements and benefits from the NCMS

There are four main models of how NCMS is implemented throughout China. The models differ in how they reimburse inpatient and outpatient services and/or whether they do so through a medical savings account.³

The first model is implemented in 65.26% of the rural counties in China. Inpatient services are reimbursed according to a formula, while outpatient services, including preventive care, are paid for through a medical savings account. Each household has its own medical savings account, with household members depositing their contributions into this account and then spending money from it. Only household members are entitled to the funds in the account, which is used mainly for outpatient services. There is a deductible and a reimbursement cap for using a medical savings account.

The second model is used in 6.7% of counties. The inpatient reimbursement policy is the same as in the first model; the main difference is in outpatient reimbursement. Under this model, there is no medical savings account designated for outpatient services and preventive-care usage. These services are reimbursed according to a certain formula through collective funds, usually with no deductible and no reimbursement cap (Du and Zhang, 2007). Counties usually provide one free physical check-up per year for those who participate in the NCMS but do not use any medical services that require NCMS reimbursement within that year.

The third model reimburses inpatient services as well as outpatient services for catastrophic diseases, with separate deductibles and reimbursement caps; 11.17% of counties use this model. The fourth model, used by 16.87% of all counties, is one in which the NCMS reimburses inpatient services but not outpatient services.

Traditionally, the reimbursements for the NCMS have put more emphasis on inpatient services than outpatient services. However, more recently, there has been a general trend toward including outpatient services and physical check-ups in patient reimbursements (Du and Zhang, 2007). In addition, some counties provide insurance coverage for an annual physical examination. Overall, there has been an increasing trend in the amount of coverage per capita and an increase in the range of services offered (Du and Zhang, 2007).

From the inception of the NCMS until the end of 2006, NCMS has reimbursed 470.5 million person-times, totaling 24.93 billion RMB. Specifically, in 2004, 2005, and 2006 there were 76 million, 122.36 million, and 272.15 million person-times reimbursed under the NCMS with total reimbursement

³The statistics provided in this section are mainly from 'The Development on China's Health, No. 3' edited by Du and Zhang (Du and Zhang, 2007).

amounts of 2.63 billion RMB, 6.17 billion RMB, and 15.58 billion RMB, respectively. That is, the amount per person-time reimbursement averaged 34.69 RMB, 50.46 RMB, and 57.24 RMB in the years 2004, 2005, and 2006, respectively (Du and Zhang, 2007).

3. LITERATURE REVIEW

Numerous studies have investigated the NCMS program. Some of these studies have focused on describing the program. For example, Mao (2005) described the design of the NCMS and the progress of the pilot program in great detail, and Brown *et al.* (2008) explored the variations in the design of the NCMS programs across different counties and proposed multiple ways to measure their success.

Meanwhile, other studies have focused on the causal effects of the NCMS, rather than focusing on its design and implementation. Yip *et al.* (2008) conducted a random experiment in which some counties were randomly assigned to control groups and others were randomly assigned to implement Rural Mutual Health Care (RMHC), an insurance intervention program providing first dollar coverage for inpatient and outpatient services that has been previously tested in three western Chinese towns. The goal was to investigate whether RMHC affected access to care. The authors found that the RMHC program increased the utilization of outpatient services and reduced self-medication. In contrast, the authors found that an alternative government-supported program that combines medical saving accounts with a high-deductible catastrophic insurance (referred to as the NCMS program in their paper) had no impact on use of outpatient services and self-medication.

Wagstaff *et al.* (2009) authored the study most relevant to our current research. In 2005, researchers conducted a survey in 10 counties that had implemented the NCMS during the 2003 wave of the National Health Service Survey. Using the DDPSM, the study compared the outcomes of these 10 counties with those of five other counties that had not implemented the NCMS pilot program. They found that enrollment was lower among poor households and higher among households with chronically sick members. They also found that the NCMS had increased overall utilization of inpatient and outpatient services, but that this utilization was disproportionately higher in wealthier households. That is, utilization among the wealthy increased, while it remained unchanged among poorer households.

In the literature there is still no consensus on the program's effects on outpatient care, inpatient care, and self-medication. A possible reason for this lack of consensus is that research on the NCMS has mainly focused on its implementation in specific areas instead of across the nation as a whole. Since local governments have the authority to design and implement their own NCMS program, the effects of the NCMS program might be heterogeneous.

This study uses data from the 2000, 2004, and 2006 (the most recent data release date) CHNS to provide an updated look at the effectiveness of the NCMS.⁴

4. DATA AND SUMMARY STATISTICS

The CHNS covered nine provinces that vary substantially in terms of geography, economic development, public resources, and health indicators.⁵ With data sets covering four counties in each surveyed province, this sample included 36 counties overall. The CHNS sampled from urban and rural

⁴We have also estimated the effects of NCMS on various outcomes based on only 2000 and 2006 data. The results, though not reported, are similar to estimates based on the 2000, 2004, and 2006 samples.

⁵This survey was conducted by the Carolina Population Center at the University of North Carolina at Chapel Hill, the National Institute of Nutrition and Food Safety, and the Chinese Center for Disease.

areas, from rich and poor provinces, and from rich and poor counties within these provinces, and tried to sample across all economic strata within a county. The first survey round of the CHNS was conducted in 1989. Six subsequent rounds were conducted in 1991, 1993, 1997, 2000, 2004, and 2006, respectively. The three most recent rounds are used in this study, yielding 23 328 rural registrant observations.

The NCMS is targeted at individuals with an agricultural *hukou* (resident registration). Anyone with an agricultural *hukou* is eligible. We started with 19 444 observations holding agriculture *hukou* and living in rural areas. We further excluded those with missing information on key variables such as age, family size, household income, or insurance status information. As shown in Table II, the final pool of observations numbers is 17 984.⁶

While the CHNS asked whether an individual had CMS, it did not distinguish between the old CMS and the current NCMS. Our first step was to separate individuals with CMS into those covered under the old CMS and those covered under the current NCMS. In principle, we were unable to separately evaluate these two programs at the individual level, since this is not specifically separated in the survey. Fortunately, we have confidential data from the community level; this survey asked government officials from each community whether the CMS had been implemented in their community, and if so, it asked the starting date. Knowing that the pilot implementation of the NCMS started in 2003, it is clear that those communities that began the CMS before 2003 were implementing the old CMS. Therefore, we defined those CMS plans that started to operate in or after 2003 as the NCMS.

Given our ability to distinguish between the old CMS and the current NCMS at the community level, we could also easily make the same distinction at the individual level. If an individual reported participating in the CMS and was at the same time living in a community that had adopted the current NCMS, we defined this individual as having participated in the NCMS. On the other hand, if an individual reported participating in the CMS and was at the same time living in a community that had adopted the old CMS, we defined this individual as having participated in the old CMS.⁷

Because we needed to use county participation as an instrument in our estimation, we had to also define whether or not a county had implemented the NCMS. Since NCMS implementation occurs at the county level, if any community within a county was known to have adopted the NCMS, then the county as a whole was defined as having implemented the NCMS. Table I shows the inception of the NCMS across provinces over time defined in this way. As is clear from this table, there has been a large increase in the number of counties implementing the NCMS over time. Only three out of 36 surveyed counties participated in the NCMS in 2004. However, in 2006, the number of participating counties increased drastically to 22.

Table II shows the summary statistics of the entire rural sample by insurance status.⁸ The 'All' column shows the mean of the pooled rural sample, followed by three columns showing, respectively, the means for NCMS participants, uninsured people, and people with other insurance. The vast majority of person-year observations are either uninsured or covered under the NCMS. Specifically, 14 005

⁶For a more detailed description of the number of observations excluded from this analysis, please refer to Appendix Table AI.

⁷To test the robustness of our results, we have adopted two additional alternative NCMS definitions: (1) Because the government requires NCMS participation at the household level, we code NCMS participation to be 'one' if at least one household member had enrolled in NCMS; (2) It is possible that an individual had simultaneously enrolled in NCMS and other insurance plans. In the main regressions, we code individuals as having NCMS insurance as long as the individual is enrolled in NCMS, regardless of enrollment statuses in other plans. However, there may be significant differences between individuals enrolled in only NCMS, and those with differing insurance situations. Thus, as a robustness check, we code insurance status as four categories: (1) Enrolled in NCMS and one or more other insurance plans; (2) Enrolled only in NCMS; (3) Enrolled only in one or more non-NCMS insurance plans; and (4) Enrolled in no plans. The results from re-estimation, not reported due to space limitations, indicate that our results are robust.

⁸Detailed variable descriptions are listed in Table AII.

Table I. Implementation of NCMS across provinces

	2000	2004	2006
Liaoning	0	0	4
Heilongjiang	0	0	3
Jiangsu	0	1	3
Shandong	0	1	3
Henan	0	0	1
Hubei	0	0	3
Hunan	0	1	1
Guangxi	0	0	2
Guizhou	0	0	2

Note: In each province, four counties were interviewed. The table above indicates the number of counties participating in the NCMS in each wave.

observations (78%) are uninsured, 2268 (13%) are covered under the NCMS, and only 1711 (10%) are covered under other insurance schemes.

The key dependent variables in our analysis are the following: self-reported health, sickness or injury in the last four weeks, utilization of preventive care in the last four weeks, utilization of formal medical services in the last four weeks, and diagnosed diseases.⁹ The first row in Table II shows the average for self-reported health, for which the rating of 4 is Poor, 3 is Fair, 2 is Good, and 1 is Very Good. Row 1 shows that, on average, people who participated in the NCMS were more inclined than uninsured people to report being less healthy. Specifically, the average score for NCMS participants is 2.32, while the average score for uninsured participants is 2.29. Another indicator of fitness is the incidence of sickness or injury in the previous four weeks. Of the NCMS participants, 11% reported feeling sick or injured in the past four weeks; this percentage is 2% less among the uninsured. Overall, the first panel of Table II shows some indication that people who are more ill and thus possibly likely to induce medical costs are more likely to participate in the NCMS.

Panel 2 of Table II shows utilization of medical care by insurance type. People covered under the NCMS are 2.4% more likely to have used preventive medical service in the last four weeks than those in the uninsured group. This may indicate that being enrolled in the NCMS leads to better access to preventive care. There are two types of preventive care: (1) general physical examination; and (2) other types of examinations for specific conditions, such as tumor screening, vision or hearing examination, prenatal examination, gynecological examination, etc. Because some NCMS programs provide one free annual general physical examination for participants who do not use other services that require reimbursement from NCMS, enrolling in the NCMS may increase the probability of getting general physical examinations.

Row 2 of Panel 2 indicates the percentage of people who report receiving general physical examinations. The probability of receiving a general physical examination for the NCMS participants is 1.48 percentage points (1.90–0.42%) higher than for the uninsured group. This indicates that participating in the NCMS increases the use of preventive-care services for the purpose of having general physical examinations. When asked whether they had sought formal medical care in the last four weeks, 1% of observations from NCMS participants and the uninsured group reported that they had sought formal medical care.

A potential problem with utilization measures, however, is that they may confound access and morbidity. That is, when we observe people seeking more formal medical care, it is not clear whether we should interpret this as people having better access to medical care or people being more ill and thus having a greater need to seek formal medical care.

⁹Table AIII shows more detailed summary statistics by insurance type and by wave.

Table II. Summary statistics by insurance type (three waves combined)ⁱ

Variables	All	NCMS	Uninsured	Other insurance
<i>Dependent variables</i>				
<i>Panel 1: Health-related variables</i>				
Self-reported health (1 = Very Good 2 = Good 3 = Fair 4 = Poor ^a)	2.29	2.32	2.29	2.22* ^h
Self-reported health is Very Good or Good	0.63	0.62	0.63	0.65
Sick or injured in the past 4 weeks ^b	0.09	0.11	0.09*	0.13
<i>Panel 2: Utilization</i>				
Any preventive care utilization in last 4 weeks ^c	0.0200	0.0367	0.0127*	0.0567*
a. General physical examination	0.0087	0.0190	0.0042*	0.0313*
b. Other preventative medical services	0.0113	0.0177	0.0084	0.0254*
Any formal medical care in last 4 weeks ^d	0.01	0.01	0.01*	0.01
Any formal medical care in last 4 weeks (includes only those who felt sick in last 4 weeks) ^e	0.16	0.11	0.18	0.08
Visiting folk doctors in the past 1 year ^f	0.04	0.03	0.04	0.03
Out-of-pocket ^g	178.49	164.08	201.36	66.32
<i>Panel 3: Diseases</i>				
Measured hypertension	0.17	0.20	0.16*	0.17*
<i>Diagnosed Diseases</i>				
Hypertension	0.05	0.07	0.05	0.07*
Diabete	0.01	0.01	0.01	0.01
Heart disease	0.0033	0.0047	0.0031	0.0028
Apoplexy	0.01	0.01	0.00	0.01*
Bone fracture	0.03	0.03	0.03	0.04
<i>Panel 4: Independent variables</i>				
Enrolled in NCMS	0.13	1	0	0
Household income (RMB)	12449.86	14355.69	11602.83*	16856.77*
Log (household income + 1)	8.98	9.1	8.91*	9.35*
Family size	4.12	3.72	4.19*	4.05*
Female	0.50	0.52	0.5	0.49
Age	37.73	42.77	37.36*	34.04*
Below 18	0.23	0.15	0.22*	0.35*
18–55	0.56	0.58	0.57	0.47*
55 and Above	0.21	0.27	0.21*	0.18*
<i>Education level</i>				
Illiterate	0.22	0.24	0.21*	0.19*
Primary school	0.22	0.22	0.23	0.15*
Junior high school	0.27	0.28	0.28	0.22*
Senior high school and above	0.08	0.09	0.07*	0.09
Currently enrolled as a student	0.15	0.13	0.14	0.27*
Unspecified education level	0.06	0.04	0.06*	0.07*
<i>Marital status</i>				
Married	0.62	0.74	0.61*	0.56*
Single	0.30	0.2	0.31*	0.39*
Other (divorced or widowed)	0.06	0.06	0.06	0.04*
Unspecified marital status	0.02	0.00	0.02*	0.01*
<i>Ethnicity</i>				
Han	0.67	0.85	0.64*	0.73*
Other	0.33	0.15	0.36*	0.27*
Unspecified ethnicity	0.09	0.03	0.09*	0.10*
Number of observations	17984	2268	14005	1711

^aParticipants asked were above the age of 12. The number of observations for this variable is 13 936, 2056, 13 717, 1205 for All, NCMS, Uninsured, and Other insurance groups, respectively.

^bThe number of observations for this variable is 17 810, 2254, 13 876, 1680 for All, NCMS, Uninsured, and Other insurance groups, respectively.

^cThe number of observations for this variable is 17 683, 2262, 13 728, 1693 for All, NCMS, Uninsured, and Other insurance groups, respectively.

^dThe number of observations for this variable is 8297, 1974, 5614, 709 for All, NCMS, Uninsured, and Other insurance groups, respectively. This question was only asked in survey waves 2004 and 2006.

^eThe number of observations for this variable is 384, 76, 260, 48 for All, NCMS, Uninsured, and Other insurance groups, respectively. This question was only asked in survey waves 2004 and 2006.

^fThe number of observations for this variable is 11 009, 2260, 7589, 1160 for All, NCMS, Uninsured, and Other insurance groups, respectively.

^gThe number of observations for this variable is 652, 74, 488, 90 for All, NCMS, Uninsured, and Other insurance groups, respectively.

^hStandard errors in brackets, with asterisks (*) denote that the differences between NCMS group and other groups are significant at 5% level.

ⁱSamples used here are from wave 2000, 2004, and 2006.

One way to circumvent this problem is to focus on utilization only among those who reported feeling sick or were injured in the past four weeks. Therefore, we interpreted the absence of doctor visits when sick or injured as a true access or affordability problem. The final row of Panel 2 shows that among those who felt sick or injured in the past four weeks and are enrolled in the NCMS, 11% sought formal medical care; while among those who were sick or injured but uninsured, 18% did so. This indicates that, compared with the NCMS participants, the uninsured more frequently accessed medical care when sick. This statistic is a little surprising as, conditional on the same health conditions, we generally expect the insured group to receive more medical care than the uninsured group. However, we need to interpret the statistics with caution as the sample size is small and these differences are not statistically significant at the 5% level.

Table II, Panel 3 shows disease prevalence by insurance type. Individuals covered under NCMS are 4% more likely to have measured hypertension¹⁰ than those in the uninsured group, while no significant difference appears for any of the five doctor-diagnosed conditions.¹¹

Panel 4 of Table II shows that NCMS participants and the uninsured differ in other important aspects. Those covered under the NCMS, as compared with those who were uninsured, were wealthier, older, less educated, more likely to be married, and more likely to be of the Han ethnic group.

5. EMPIRICAL STRATEGY

5.1. Ordinary least-squared estimation (OLS)

We began our analysis by estimating the linear probability model of the effect of participating in the NCMS on health status and access to medical care. The equation we used for this model is

$$Y_{ipt} = \alpha_0 + \alpha_1 \text{NCMS}_{ipt} + \alpha_2 X_{ipt} + \tau_t + \alpha_p + \varepsilon_{ipt}$$

where Y_{ipt} is the measure of health status (self-reported health status and sickness/injury within the four weeks preceding the CHNS survey) or utilization (preventative care or formal medical care) in year t for individual i who lives in province p ; NCMS_{ipt} is an indicator of whether an individual was enrolled in the NCMS; X_{ipt} is a set of control variables including age, gender, education, marital status, ethnicity, family size, and household income; τ_t indicates time FE that control for unobservable characteristics that are constant across all regions; and α_p indicates province FE that control for unobservable characteristics of a province that are constant over time.

Where our dependent variables were binary, we also estimated a logit model and reported the average marginal effects.¹²

Even after conditioning on this detailed set of controls, however, persons who enroll themselves in the NCMS may have other unobservable characteristics that affect both their enrollment decisions and their service utilization or health status. For example, persons who are more future-oriented (who have a high degree of time preference for the future or discount it at a modest rate) might be both more likely to enroll in the NCMS and more likely to take better care of themselves. Thus, the effects of the NCMS on health outcomes are biased if there is a failure to control for time preferences.

In another example, persons covered by the NCMS might be more risk-averse and thus might be inclined to take advantage of preventive care more frequently. That is, risk aversion is positively correlated with both NCMS enrollment status and the utilization of preventive care. In this case, simple

¹⁰During the time of the survey, physical examinations are also taken to obtain an objective measure of the blood pressures of respondents. As is standard in the medical literature, we regard a respondent as being hypertensive if his/her systolic blood pressure is greater than or equal to 140 mm Hg or if his/her diastolic blood pressure is greater than or equal to 90 mmHg.

¹¹This information is obtained from the answers to a series of questions using the general form: 'Did a doctor ever tell you that you had [condition]?'

¹²Though not reported, we have also estimated a probit model, with similar results.

OLS estimation controlling for observables would overestimate the effect of NCMS enrollment on preventive care. Therefore, in addition to the OLS estimates, we present the following identification strategies to overcome this omitted variables problem.

5.2. Individual FE estimation

Taking advantage of the panel nature of the CHNS data, we used the individual FE model to overcome selection problems. With individual FE estimation, we controlled for characteristics specific to each individual that are constant over time. If unobservable characteristics such as risk aversion or time preferences remain constant over time, individual FE estimation can overcome the omitted variables problems.

5.3. Instrumental variables estimation

In addition to individual FE estimates, we used IV estimates. We instrumented for individual NCMS enrollment status using county NCMS enrollment status. Our aim was to abstract from unobservable characteristics of individuals that may be correlated with both participation in the NCMS and the dependent variables, and to achieve identification using only the recent NCMS expansions at the county level. The question, however, is whether county NCMS enrollment status is a valid instrument for individual NCMS participation.

There are two requirements for this instrument to be valid. The first requirement is the existence of a high correlation between whether an individual is participating in the NCMS and whether his/her county of residence has implemented the NCMS. As is shown in Table IV, the first-stage F statistics are over 20 with a P -value of 0.00. Since individuals can only participate in the NCMS plan when their county of residence implements the NCMS plan, it is not surprising to see a high correlation between individual NCMS participation and resident county participation.

The second requirement is the exogenous nature of a county's implementation of the NCMS relative to the individual's health status and utilization of medical services. In other words, employing this instrument assumes that the variation in the timing of expansions of the NCMS is independent of other factors that would influence individual health and utilization of medical care. Since county implementation of the NCMS was mainly in response to policy guidance from the central government and decided by the provincial governments, we believe that this is a reasonable assumption after controlling for province FE.

Table III further tests this assumption. It shows the effects of county-level characteristics on whether or not a county implements the NCMS. One county constitutes a unit of observation. The dependent variable takes the value of 1 if a county implements the NCMS, and 0 otherwise. Because the NCMS began in 2003, only survey waves 2004 and 2006 were used for this regression. Furthermore, because in 2004 the NCMS existed only in very few counties and in 2006 participation was much more widespread, the motivation behind participation in these two years may be very different. Therefore, we also estimated the probability of participation separately for these two waves.

Column 1 pools counties from 2004 to 2006 together, while Column 2 includes only counties in 2004, and Column 3 includes only counties in 2006. Since none of the coefficients in Table III are statistically significant, Table III indicates that counties that implemented the NCMS are not statistically different from non-participating counties in any way. This result is comforting because it shows that there is no selection into participation at the county level at least in terms of observables, which supports our utilization of county-level participation as an instrument.

5.4. Propensity score matching with difference-in-differences estimation

As a third strategy to estimate the causal effects of the NCMS on health and utilization outcomes, we considered propensity score matching with the difference-in-differences method. Propensity score

Table III. County level participation

	Wave 2004 and 2006	Wave 2004	Wave 2006
Fraction participating in the NCMS	0.241	0.040	0.443
Fraction of self-reported health is fair or poor	0.113	-0.402	-0.466
	[0.508]	[0.497]	[1.240]
Fraction of being sick in last four weeks	-0.762	-0.064	0.588
	[0.838]	[0.884]	[2.361]
Average log household yearly income	-0.019	-0.104	0.102
	[0.126]	[0.095]	[0.357]
Average years of schooling	-0.030	-0.012	0.075
	[0.084]	[0.083]	[0.156]
Fraction of student	2.170	1.221	3.888
	[1.401]	[1.048]	[3.244]
Fraction of education not available	3.563	3.812	0.821
	[2.586]	[2.161]	[5.653]
Fraction of year of schooling missing	-4.698	-0.516	-18.792
	[6.383]	[5.824]	[16.385]
Average age	0.003	0.037	-0.026
	[0.038]	[0.028]	[0.078]
Fraction of female	-0.522	-0.122	-2.784
	[1.660]	[1.579]	[3.717]
Fraction of currently married	0.607	1.455	-1.556
	[2.590]	[2.002]	[5.659]
Fraction of single	-1.393	2.474	-5.816
	[3.501]	[2.908]	[7.497]
Fraction of marital status missing	5.055	-0.966	
	[12.909]	[10.899]	
Fraction of nationality han	0.243	0.212	-0.085
	[0.298]	[0.242]	[0.690]
Fraction of nationality missing	-0.616	-0.410	1.985
	[0.729]	[0.589]	[4.224]
Average family size	-0.091	-0.082	0.064
	[0.144]	[0.134]	[0.280]
Fraction of wave 2006	0.255*		
	[0.128]		
Constant	0.505	-1.934	3.670
	[4.564]	[3.458]	[9.514]
Number of observations	72	36	36
Number of counties	36		
R-squared	0.588	0.68	0.516

Notes: Robust standard errors in brackets. *indicate statistical significant at the 5% level. **at 1%. The omitted category for marital status is other marital status (divorced or widow). Although not reported, controls include province dummies.

matching constructs counterfactuals on an assumption that the decision to participate in the NCMS is based on observed characteristics. This method compares the outcomes of two groups, a treatment group and a control group, both of which have the same probability of participating in the NCMS.

One potential concern with propensity score matching is that it only takes into consideration the selection biases based on observed characteristics. However, if the selection biases resulting from unobservable characteristics are constant over time, then we can remove them by combining propensity score matching with difference-in-differences estimation.

Difference-in-differences propensity score matching compares differences in each individual's outcome, before and after an individual began participating in the NCMS. For individuals who enrolled in the NCMS in 2004, *Before* is defined as the wave of data collected in 2000. For those who started participating in 2006, *Before* is defined as the waves of data collected in 2000 and 2004.

The control group includes individuals who did not participate in any of these three waves of the NCMS.

We used the nearest-4-neighbor matching method.¹³ Observations not on the common support were excluded from the analysis. To adjust for the additional sources of validity introduced by estimation of the propensity score as well as the matching process itself, bootstrapped confidence intervals have been calculated.

Appendix Table AIV shows the balancing properties of the propensity score matching and resulting reductions in observable differences between the treatment and control groups. Columns 1 and 2 (5 and 6) indicate the pre-matching (post-matching) means of each matching variable for the treatment and control groups, respectively; Columns 3 and 4 (7 and 8) provide the associated two-sample *t*-statistic and its *p* value for the pre-matching (post-matching) difference between the treatment and control groups.

Overall, matching on the estimated propensity score balanced the observable characteristics very well. As is apparent from Appendix Table AIV, matching reduced initial differences in observable characteristics between control and treated groups. After matching, the *t*-statistics were in general less than 1.96.¹⁴ In particular, log family income, which is most likely to be correlated with NCMS participation status and the outcomes of interests (self-reported health status and medical services utilization), was statistically similar between the control and treatment groups after matching.

6. ESTIMATION RESULTS

Table IV shows the estimation effects of the NCMS on utilization and health outcomes. Column 1 shows the results from the simple OLS estimation, Column 2 those using logit estimation, Column 3 those from individual FE estimation, and Columns 4 and 5 the results from IV estimation method and from propensity score with difference-in-differences estimation, respectively.

Panels 1 and 2 of Table IV show the effects of the NCMS on self-reported health status and on whether individuals felt sick or were injured in the four weeks prior to the survey. Except for the propensity score estimation results which show that enrolling in the NCMS is associated with a decrease of 2.8 percentage points in the probability of feeling sick or injured, other estimation methods do not show that the NCMS improve individual health in either health measure.¹⁵

Panel 3 of Table IV shows the estimation results for the utilization of preventive-care services. All four estimation methods consistently show that adopting the NCMS has significantly increased the probability of using preventive-care services. The OLS estimates show that enrolling in the NCMS increases the probability of utilization of any preventive care in the past four weeks by 1.7 percentage points, while it is 1.3, 1.1, and 1.5 percentage points for estimates from individual FE, IV, and propensity score matching methods, respectively. That is, participating in the NCMS increases the probability of a person's utilization of any preventive care by 60–85%, depending on estimates from different models.

Panels 4 and 5 of Table IV further look into the preventative services and examine the utilization of general physical examination and other specific examinations. As noted in the previous section, under some NCMS programs, an annual medical check-up is free if a person does not use other services that require reimbursement from the NCMS. Thus, we expect that the effect of NCMS on preventive care might be mainly due to coverage leading to eligibility for a general physical examination. As shown in Panels 4 and 5, four different estimation models consistently point out that enrolling in the NCMS

¹³Although not reported, results were also robust using nearest-1-neighbor matching and kernel matching methods.

¹⁴After matching, only three variables had *t*-statistics slightly greater than 1.96. The *t*-statistics for Han indicator, family size, and family size square are -2.27 , 2.12 , and 2.02 , respectively.

¹⁵We have also estimated the effects of NCMS on self-reported health using ordered logit regressions. We did not find that the NCMS affects self-reported health status in any category.

Table IV. Effects of the NCMS on health and utilization^a

Dependent variable	OLS estimates (1)	Logit (dy/dx) (2)	Individual fixed-effect estimates (3)	Instrumental variables estimates (4)	Propensity score matching with difference-in-differences estimates (5)
<i>Panel 1: Self-reported health is fair or poor</i>					
Enrolled in NCMS	-0.014 [0.013]	-0.016 [0.012]	0.019 [0.020]	-0.011 [0.019]	0.038 [0.021]
First-stage <i>F</i> -Statistics				21.75	
Number of Observations	13 936	13 936	13 936	13 936	3216
<i>Panel 2: Sick or injured in the last four weeks</i>					
Enrolled in NCMS	-0.001 [0.008]	-0.001 [0.006]	-0.012 [0.012]	-0.002 [0.011]	-0.028* [0.014]
First-stage <i>F</i> -Statistics				23.59	
Number of observations	17 810	17 810	17 810	17 810	3740
<i>Panel 3: Any preventative care utilization in past four weeks</i>					
Enrolled in NCMS	0.017** [0.004]	0.015** [0.005]	0.013* [0.006]	0.011* [0.006]	0.015* [0.007]
First-stage <i>F</i> -Statistics				23.33	
Number of observations	17 683	17 683	17 683	17 683	3731
<i>Panel 4: General physical examination in last four weeks</i>					
Enrolled in NCMS	0.013** [0.002]	0.011** [0.004]	0.013** [0.004]	0.012** [0.004]	0.015** [0.004]
First-stage <i>F</i> -Statistics				23.52	
Number of observations	17 683	17 683	17 683	17 683	3731
<i>Panel 5: Other preventative medical service in last four weeks</i>					
Enrolled in NCMS	0.004 [0.003]	0.004 [0.003]	0.000 [0.004]	-0.001 [0.004]	-0.006 [0.005]
First-stage <i>F</i> -Statistics				23.52	
Number of observations	17 683	17 683	17 683	17 683	3731
<i>Panel 6: Any formal medical care in last four weeks^b</i>					
Enrolled in NCMS	-0.001 [0.003]	-0.001 [0.001]	-0.011 [0.008]	-0.005 [0.005]	-0.01 [0.006]
First-stage <i>F</i> -Statistics				24.79	
Number of observations	8297	8297	8297	8297	2351
<i>Panel 7: Any formal medical care in last four weeks (includes only those who felt sick in last four weeks)</i>					
Enrolled in NCMS	-0.01 [0.049]	0.008 [0.116]	-0.423 [1.430]	0.031 [0.095]	-0.103 [0.073]
First-stage <i>F</i> -Statistics				2.35	
Number of observations	384	384	384	384	77
<i>Panel 8: Visiting folk doctors in the past 1 year</i>					
Enrolled in NCMS	-0.019** [0.005]	-0.015** [0.003]	-0.008 [0.009]	-0.049** [0.008]	-0.014 [0.009]
First-stage <i>F</i> -Statistics				23.89	
Number of observations	11 009	11 009	11 009	11 009	3617
<i>Panel 9: ln(out-of-pocket) in last four weeks^c</i>					
Enrolled in NCMS	0.126 [0.332]	—	0.045 [1.084]	0.039 [0.549]	1.215 [1.006]
First-stage <i>F</i> -Statistics				1.28	
Number of observations	652	—	652	652	17

Notes: ^aRobust standard errors in brackets. *indicate statistical significant at the 5% level. **at 1%. Control variables include: ln(household income); years of schooling; age; gender; marital status; ethnicity; family size; survey wave dummies; and province dummies. ^bSince the question 'Any formal medical care in last four weeks' is only asked in survey waves 2004 and 2006, samples used for panel 4 and panel 5 are only from these two waves. ^cLogit model is not applicable to out-of-pocket, since it is continuous.

increases the probability of receiving a general physical examination, while it does not affect the probability of receiving other preventive services, which supports our hypothesis.

Panels 6 and 7 of Table IV show estimates of the effect of NCMS on the incidence of seeking formal medical services. The estimation in Panel 6 includes everyone in the sample; the estimation in Panel 7

includes only those who felt sick or injured in the past four weeks.¹⁶ As is consistently shown across the four estimating schemes, participating in the NCMS does not affect the utilization of formal medical services, regardless of whether or not we exclude people who felt sick or injured in the past four weeks.

We were interested in finding out whether people had reduced their use of traditional Chinese folk doctors as a result of the NCMS.¹⁷ Panel 8 of Table IV shows the estimation results for the utilization of Chinese folk doctors. Unlike the measures of sickness/injuries and the utilization of preventive and formal care whose recall period is four weeks, the recall period for the utilization of Chinese folk doctors is one year. Panel 8 shows some indications that NCMS is associated with decreased use of traditional Chinese folk doctors. The IV estimates show that enrolling in the NCMS decreases the probability of using folk doctors by 4.9 percentage points. As the NCMS does not reimburse costs from services by folk doctors, the lowest level of reimbursement is at village clinics. Thus, it is not surprising that the NCMS is associated with decreased use of Chinese folk doctors.¹⁸ However, the results need to be interpreted with caution since they are not statistically significant when using individual FE and propensity score matching estimation methods.

Finally, Panel 9 examines the effect of the NCMS on out-of-pocket expenditure. Out-of-pocket expenditure is a potentially interesting outcome to look at as a Chinese government official might reasonably say that the goal of the program is not so much to encourage extra utilization, but rather to reduce the out-of-pocket amount people spend on health care. As indicated in Panel 9, participating in the NCMS does not have effects on out-of-pocket expenditures.

Table V shows the effects of NCMS on measured and doctor-diagnosed diseases. Panel 1 looks into the effects of NCMS on measured hypertension. We have found no significant effects on the prevalence of hypertension except for the IV estimation result. Panel 2 examines the effects of NCMS on five doctor-diagnosed conditions including hypertension, diabetes, heart disease, apoplexy, and bone fracture, in order to further investigate whether or not NCMS deteriorates patient health. The results indicate no significant impact across all specifications. This is consistent with earlier results for self-reported health measures, which also show that NCMS does not improve population health.

7. CONCLUSIONS

Expansion of public health insurance is currently a popular public issue in China, and the Chinese government has made many efforts to launch public health programs for various populations.¹⁹ The goal of the current Chinese government is to achieve universal health care by the year 2010 (China Ministry of Health *et al.*, 2003). The strong support for universal public health insurance reflects the assumption that lack of insurance is responsible for poor health, which may in turn lead to medical debt and poverty. Furthermore, there is some public support for the concept that health care is a basic human right (Mann *et al.*, 1999). Unfortunately, despite the rapid expansion of insurance coverage, little is known about the utilization and health effects of launching and expanding public health insurance coverage.

The goal of this study is to address this question. This study used CHNS to evaluate the impact of the newly adopted NCMS on utilization of health care, out-of-pocket medical services expenditure, and general health status in rural China. In addition to simple OLS and logit estimation, we also used three other estimation methods to correct the omitted variable bias when evaluating the impact of this

¹⁶To avoid a possible small sample problem stemming from a limited timeframe of four weeks, we have also run regressions on formal medical services, using a sample excluding those whose self-reported health had been 'very good' in 2000. Using this alternate methodology, we have similarly not found any statistically significant effects.

¹⁷Chinese folk doctors refer to those who work in private hospitals are not licensed and have only limited medical training.

¹⁸We would like to thank an anonymous referee for the suggestion of examining out-of-pocket expenditure outcome.

¹⁹For example, the government launched the NCMS in 2003 (State Council, 2002), the Urban Employee Essential Medical Scheme in 1999, which made all employed workers eligible for coverage (State Council, 1998), and the Urban Resident Essential Medical Scheme in 2007, which covers urban residences that are not employed. (State Council, 2007).

Table V. Effects of the NCMS on diseases

Dependent variable	OLS estimates	Logit (dy/dx)	Individual fixed-effect estimates	Instrumental variables estimates	Propensity score matching with difference-in-differences estimates
<i>Panel 1. Measured hypertension</i>					
Enrolled in NCMS	0.015 [0.010]	0.014 [0.011]	0.017 [0.013]	0.057** [0.015]	0.016 [0.017]
First-stage <i>F</i> -Statistics				18.49	
Number of observations	14 326	14 326	14 326	14 326	2995
<i>Panel 2. Diagnosed diseases</i>					
<i>Hypertension</i>					
Enrolled in NCMS	0.001 [0.006]	-0.001 [0.006]	0.007 [0.007]	-0.001 [0.009]	-0.004 [0.009]
First-stage <i>F</i> -Statistics				22.29	
Number of observations	13 926	13 926	13 926	13 926	3213
<i>Diabetes</i>					
Enrolled in NCMS	0.000 [0.002]	0.000 [0.002]	-0.002 [0.003]	0.003 [0.003]	-0.005 [0.003]
First-stage <i>F</i> -Statistics				22.56	
Number of observations	13 780	13 780	13 780	13 780	3221
<i>Heart disease</i>					
Enrolled in NCMS	0.001 [0.002]	0.000 [0.002]	0.003 [0.002]	0.002 [0.003]	0.001 [0.003]
First-stage <i>F</i> -Statistics				20.64	
Number of observations	13 137	13 137	13 137	13 137	3074
<i>Apoplexy</i>					
Enrolled in NCMS	0.004 [0.002]	0.003 [0.002]	0.003 [0.003]	0.006 [0.003]	0.000 [0.004]
First-stage <i>F</i> -Statistics				20.68	
Number of observations	13 083	13 083	13 083	13 083	3071
<i>Bone fracture</i>					
Enrolled in NCMS	0.002 [0.005]	0.002 [0.005]	0.009 [0.006]	0.007 [0.007]	0.010 [0.007]
First-stage <i>F</i> -Statistics				21.62	
Number of observations	13 952	13 952	13 952	13 952	3225

Notes: Robust standard errors are in brackets. * indicates statistical significance at the 5% level. ** indicates statistical significance at the 1% level. Control variables are: ln(household income); years of schooling; age; gender; marital status; ethnicity; family size; survey wave dummies and province dummies.

insurance program. The results obtained using these three identification strategies (individual FE, IVs estimation, and propensity score matching with difference-in-differences estimation) consistently revealed improvement in preventive-care utilization for NCMS participants. However, there were no improvements in access to formal medical care and no indication that the NCMS improved the health statuses of individuals. There was also no evidence that NCMS participation has relieved financial burden, as measured by out-of-pocket expenditures among patients.

The improvement in preventive-care utilization and the lack of improvement in formal medical services could be due to three reasons: (1) the deductibles were generally high, which might have prevented people from using formal medical services; (2) while many counties had household medical savings accounts that covered both outpatient care and preventive services, the budget for the medical savings account was very limited and might have been sufficient for preventive care, which is generally cheaper, but not sufficient for formal medical services; (3) some counties also provided participants with free preventive service once per year provided these participants did not use any other medical services paid by the NCMS during that year.

Why has not the improvement in preventive care led to an improvement in general health status? One possibility is that preventive care can be defined as a mere annual physical check-up. Suppose that after

the annual check-up individuals find that they have health problems, but cannot afford to seek any medical treatment, there would be no improvement in health status in such a scenario. Since there is no significant improvement in access to formal medical care, a lack of significant improvement in health status is understandable. In general, it seems that while there has been a huge increase in insurance coverage, the impact of the NCMS is still very limited and the program's effectiveness must be improved in order to realize the goals of improving the population's health and of reducing poverty in rural China.

The results from this paper should be interpreted with caution as there are some important limitations to this paper. First of all, one possible reason for not finding effects of NCMS on formal medical care is the small sample size and short time period (four weeks) of recalling any formal medical care utilization. The NCMS recall period of four weeks for health care utilization is problematic, especially for inpatient care, as most surveys use 12 months for inpatient care. It would be beneficial if future research can focus on formal medical care in one year prior to the survey.

The second limitation of using CHNS data is that CHNS does not allow us to explore the intensity of care use. The NCMS may not affect the probability of people seeking medical assistance when they have fallen ill, but it may affect how they are routed through the system and how many contacts with the health system they have. The NCMS provides disincentives for people to seek treatment directly at the hospital level. People might go to a village clinic first and then get referred upward to township hospitals, and later on to county-level hospitals, instead of going directly to the hospital. Their decisions to seek care would not change, but they may end up getting treated in only village clinics and not hospitals, and thus may end up seeing more health care providers on average as a result of the roundabout referral process.

Third, we do not know whether the NCMS provides health benefits that are overlooked when we solely investigate self-reporting of health and of illness or injury in the last four weeks. In future work, we hope to move beyond these relatively crude, self-reported measures of health to investigate the effects of the NCMS on other, more detailed indicators of objective or physician-assessed health status. The availability of micro-data on objective health outcomes would be an invaluable tool for such future assessments of the effects of public insurance on health.

This research raises a number of interesting questions that are crucial to a better understanding of the role of public insurance. First of all, 31% of people who live in counties where the NCMS has been implemented do not participate.²⁰ Are the people who do not take up coverage despite being eligible less needy, or do they simply face larger informational and other barriers? Some rural residents in China might not have any concept of insurance at all and thus simply do not want to join the NCMS because they do not know the benefits of the program. They may simply think NCMS is a tool for the government to obtain money from them as a form of tax. Anecdotal evidence indicates that some rural residences, upon the first time that they receive reimbursement, cannot believe that they indeed are able to get reimbursed for their medical expenditures. If knowledge or the concept of insurance is a major barrier for rural residents from participating in the NCMS, the government needs to work on educating people regarding the program.

Second, the success of the NCMS might be greatly impacted by changes in the behavior of hospitals and physicians in response to the implementation of this program. Currie *et al.* (1995) found that increases in fees paid to obstetricians/gynecologists by the Medicaid program were associated with declines in infant mortality, which suggests that supply-side policies can have important effects on access to physicians and on outcomes. In our case, the way in which hospitals and physicians respond to the NCMS may also have a great impact on its success and efficiency. For example, there is anecdotal evidence that some hospitals use more costly procedures or equipments for NCMS participants in response to the implementation of the NCMS. Therefore, participants' relative out-of-pocket expenses may not necessarily be lower than before NCMS participation (Du and Zhang, 2007). If this is true, it might partly explain why access to formal medical services did not increase.

²⁰Authors' calculation from the 2004 and 2006 CHNS data. Specifically, in 2004, 54.4% of people who live in counties where NCMS has been implemented do not participate while the number for 2006 is 28.4%.

Third, there is huge surplus in the NCMS funds. Mao (2005) found that 27.28% of counties in eastern provinces, 32.51% in central provinces, and 55.98% in western provinces have large surpluses. This is partly because the risk pooling level for the NCMS at the county level is too narrow. There is a chance that the population in an entire county might be subjected to a widespread disease outbreak. Thus, the NCMS officials are worried that if this type of situation were to happen, the NCMS might go bankrupt. Therefore, the NCMS officials set the deductibles too high and the copayment rates too low in order to guard against bankruptcy of the NCMS system.

From this risk pooling point of view, it is beneficial to enlarge the NCMS risk pooling level from just one individual county to several counties or even the provincial level. Doing this, however, might increase the administrative cost of the NCMS. In order to increase risk-sharing for the NCMS but maintain reasonable administrative costs, future research on the appropriate risk pooling level for the NCMS is needed. Further research is also needed to examine the appropriate deductibles and copayment rates so that the NCMS premiums collected from participants are well spent and are used to improve the population's health.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

APPENDIX

The detailed description of the number of observations excluded from the summary statistics are given in Table AI. The balancing properties of the propensity score matching and resulting reductions in observable differences between the treatment and control groups are given in Table AII and the matching balancing properties between NCMS and control are given in Table AIV. The details of the summary statistics by insurance type by wave are given in Table AIII.

Table AI. Number of observations

Data	Number excluded	Number remaining	Used in Table No.
CHNS 2000, 2004, 2006		72 587	
Restrict to observations with agriculture <i>hukou</i> and live in rural areas	53 143	19 444	
Exclude if age is missing	443	19 001	
Exclude if family size is missing	267	18 734	
Exclude if family size is zero	5	18 729	
Exclude if household income is negative	98	18 631	
Exclude if household income is missing	207	18 424	
Exclude if starting time of community cms implementation is unknown	196	18 228	
Exclude if CMS is missing	241	17 987	
Exclude if insurance is missing	3	17 984	Table 2

Note: Due to missing information in the dependent variables, there are 13 936 observations included in self-reported health analysis; 17 810 observations included in 'illness or injury in the past four weeks' analysis; 17 687 observations in 'Any preventive care utilization in the past 1 year' analysis; 8297 observations in 'Seek formal medical care in the last four weeks' analysis.

Table AII. Variables description

Variables	Description
Dependent variables	
<i>Panel 1: Health-related variables</i>	
Self-reported health(1 = Very Good 2 = Good 3 = Fair 4 = Poor ^a)	1 if self-reported health status is Very Good, 2 if Good, 3 if Fair, 4 if Poor
Self-reported health is Very Good or Good	1 if self-reported health status is Very Good or Good, 0 if Fair or Poor
Sick or injured in the past four weeks ^b	1 if individual was sick or injured in last 4 weeks, 0 otherwise
<i>Panel 2: Utilization</i>	
Any preventative care utilization in last four weeks ^c	1 if individual had preventative medical service in the last four weeks, 0 otherwise
a. General physical examination	1 if individual had general physical examination, 0 otherwise
b. Other preventative medical service	1 if individual had preventative medical service except for general physical examination, 0 otherwise
Any formal medical care in last four weeks ^d	1 if individual sought formal medical service in last 4 weeks, 0 otherwise
Any formal medical care in last four weeks (includes only those who felt sick in last four weeks) ^e	1 if individual sought formal medical service conditional on felt sick in last four weeks, 0 if not conditional on felt sick in last four weeks
Visiting folk doctors in the past 1 year	1 if visiting folk doctors in the past 1 year, 0 otherwise
Out-of-pocket	Spending for diseases in last four weeks
<i>Panel 3: Diseases</i>	
Measured hypertension	1 if average measured blood pressure is above 140, 0 otherwise
<i>Diagnosed diseases</i>	
Hypertension	1 if doctor diagnosed hypertension last year, 0 otherwise
Diabetes	1 if doctor diagnosed diabetes last year, 0 otherwise
Heart disease	1 if doctor diagnosed heart disease last year, 0 otherwise
Apoplexy	1 if doctor diagnosed apoplexy last year, 0 otherwise
Bone fracture	1 if individual ever had bone fracture, 0 otherwise
<i>Panel 4: Independent variables</i>	
Enrolled in NCMS	1 if enrolled in the NCMS, 0 otherwise
Household income (RMB)	Total yearly household income (RMB)
Log(household income + 1)	Log (total yearly household income+1)
Family size	Number of people in the household
Female	1 if individual is female, 0 otherwise
<i>Age</i>	
Below 18	1 if age <18, 0 otherwise
18–55	1 if 18 ≤ age ≤ 55, 0 otherwise
55 and Above	1 if age > 55, 0 otherwise
<i>Education level</i>	
Illiterate	1 if individual never finished primary school, 0 otherwise
Primary school	1 if individual has finished primary school or below, 0 otherwise
Junior high school	1 if individual has finished junior high school, 0 otherwise
Senior high school and above	1 if individual has finished senior high school, 0 otherwise
Currently enrolled as a student	1 if individual is still a student, 0 otherwise
Unspecified education level	1 if education level is missing, 0 otherwise
<i>Marital status</i>	
Married	1 if individual is currently married, 0 otherwise
Single	1 if individual is single, 0 otherwise
Other (divorced or widowed)	1 if individual has marital status as divorced or widow, 0 otherwise
Unspecified marital status	1 if individual marital status is missing
<i>Ethnicity</i>	
Han	1 if ethnicity is han, 0 otherwise
Other	1 if ethnicity is other minority, 0 otherwise
Unspecified ethnicity	1 if ethnicity is missing, 0 otherwise

^aParticipants asked were above the age of 12. The number of observations for this variable is 13 936, 2056, 13 717, 1205 for All, NCMS, Uninsured, and Other insurance groups, respectively.

^bThe number of observations for this variable is 17 651, 2254, 13 717, 1680 for All, NCMS, Uninsured, and Other insurance groups, respectively.

^cThe number of observations for this variable is 17 529, 2264, 13 590, 1675 for All, NCMS, Uninsured, and Other insurance groups, respectively.

^dThe number of observations for this variable is 8297, 1974, 5614, 709 for All, NCMS, Uninsured, and Other insurance groups, respectively. This question was only asked in survey waves 2004 and 2006.

^eThe number of observations for this variable is 384, 76, 260, 48 for All, NCMS, Uninsured, and Other insurance groups, respectively. This question was only asked in survey waves 2004 and 2006.

Table AIII. Summary statistics by insurance type be wave

Variables	2000				2004				2006			
	All	NCMS ^a	Uninsured	Other insurance	All	NCMS	Uninsured	Other insurance	All	NCMS	Uninsured	Other insurance
<i>Dependent variables</i>												
<i>Panel 1: Health-related variables</i>												
Self-reported health(1 = Very Good 2 = Good 3 = Fair 4 = Poor)	2.22	—	2.24	2.03	2.29	2.08	2.32 ^{ab}	2.16	2.35	2.34	2.34	2.50*
Self-reported health is Very Good or Good	0.67	—	0.67	0.73	0.62	0.72	0.61*	0.7	0.60	0.61	0.6	0.50*
Sick or injured in the past 4 weeks	0.06	—	0.06	0.08	0.12	0.09	0.12	0.14*	0.11	0.11	0.1	0.20*
<i>Panel 2: Utilization</i>												
Any preventative care utilization in last four weeks	0.0133	—	0.0063	0.0847	0.0213	0.0240	0.0177	0.0469	0.0277	0.0377	0.0193	0.0304*
a. General physical examination	0.0082	—	0.0026	0.0655	0.0061	0.0120	0.0048	0.0141	0.0122	0.0196	0.0072*	0.0070*
b. Other preventative medical service	0.0051	—	0.0037	0.0192	0.0153	0.0120	0.0130	0.0328	0.0155	0.0181	0.0121	0.0234
Any formal medical care in last 4 weeks ^c	—	—	—	—	0.02	0.00	0.02*	0.01	0.01	0.01	0.01	0.01
Any formal medical care in last four weeks (includes only those who felt sick in last 4 weeks)	—	—	—	—	0.19	0.00	0.21*	0.08	0.10	0.11	0.1	0.09
Visiting folk doctors in the past 1 year	0.04	—	0.05	0.03	0.03	0.01	0.03*	0.03	0.05	0.03	0.06*	0.03
Out-of-Pocket	119.63	—	124.18	76.24	222.03	307.50	249.66	75.52	150.69	155.89	187.31*	31.32
<i>Panel 3: Diseases</i>												
Measured hypertension	0.14	—	0.16	0.14	0.17	0.14	0.18	0.15	0.19	0.21	0.17	0.20*
<i>Diagnosed Diseases</i>												
Hypertension	0.0439	—	0.057100002	0.0429	0.050700001	0.0338	0.0493	0.0669	0.063600004	0.0708	0.054	0.0870*
Diabete	0.0071	—	0.0058	0.0072	0.0047	0.0068	0.0044	0.0059	0.0055	0.0062	0.0031	0.0173
Heart disease	0.0040	—	0.0000	0.0044	0.0017	0.0083	0.0014	0.0025	0.0042	0.0045	0.0037	0.0066
Apoplexy	0.0024	—	0.0029	0.0023	0.0067	0.0025	0.0052	0.0148	0.0078	0.0089	0.0075	0.0033
Bone Fracture	0.0268	—	0.0372	0.0259	0.032499999	0.0135	0.0319*	0.0433	0.0295	0.0349	0.0228	0.0434*
<i>Panel 4: Independent variables</i>												
Enrolled in NCMS	0.00	—	0.00	0.00	0.03	1	0	0	0.41	1	0	0
Household income (RMB)	9954.89	—	9622.50	13427.61	15062.74	15886.99	14317.44	20246.64*	13226.75	14233.97	11836.85*	16899.87*
Log(household income + 1)	8.82	—	8.77	9.25	9.16	9.22	9.12	9.49*	9.00	9.09	8.88*	9.29*
Family size	4.29	—	4.29	4.30	4.09	3.94	4.13	3.84	3.89	3.7	4.04*	3.97*
Female	0.49	—	0.49	0.49	0.51	0.51	0.51	0.49	0.52	0.52	0.52	0.49
Age	34.35	—	34.64	31.24	38.35	38.04	38.98	33.88*	41.85	43.15	41.36*	38.51*
Below 18	0.26	—	0.24	0.37	0.23	0.28	0.21	0.36*	0.18	0.14	0.19*	0.29*
18–55	0.59	—	0.60	0.49	0.54	0.51	0.55	0.47	0.54	0.58	0.52*	0.44*
55 and Above	0.15	—	0.16	0.13	0.23	0.21	0.23	0.17	0.28	0.28	0.29	0.27
<i>Education level</i>												
Illiterate	0.21	—	0.21	0.20	0.20	0.16	0.2	0.19	0.25	0.24	0.27*	0.17*
Primary School	0.22	—	0.23	0.14	0.24	0.17	0.25*	0.16	0.20	0.22	0.18*	0.17*
Junior high school	0.28	—	0.29	0.23	0.27	0.3	0.28	0.21*	0.27	0.28	0.27	0.23*
Senior high school and above	0.07	—	0.07	0.08	0.07	0.12	0.07	0.07	0.09	0.09	0.09	0.13*
Currently enrolled as a student	0.17	—	0.16	0.27	0.16	0.2	0.14*	0.30*	0.13	0.12	0.12	0.24*

Table AIII. *Continued*

Variables	2000				2004				2006			
	All	NCMS	Uninsured	Other insurance	All	NCMS	Uninsured	Other insurance	All	NCMS	Uninsured	Other insurance
Unspecified education level	0.06	—	0.05	0.08	0.07	0.05	0.07	0.07	0.06	0.03	0.08*	0.06*
<i>Marital status</i>												
Married	0.55	—	0.55	0.52	0.64	0.62	0.66	0.56	0.70	0.75	0.68*	0.61*
Single	0.36	—	0.35	0.42	0.30	0.34	0.28	0.4	0.23	0.19	0.25*	0.33*
Other (divorced or widowed)	0.05	—	0.05	0.05	0.06	0.04	0.06	0.04	0.07	0.07	0.08	0.05
Unspecified marital status	0.04	—	0.05	0.02	0.00	0	0.00*	0	0.00	0	0	0
<i>Ethnicity</i>												
Han	0.57	—	0.56	0.66	0.70	0.98	0.69*	0.76*	0.79	0.84	0.74*	0.80*
Other	0.43	—	0.44	0.34	0.30	0	0.15*	0.06*	0.21	0.12	0.19*	0.16
Unspecified ethnicity	0.06	—	0.06	0.06	0.16	0.02	0.16*	0.18*	0.05	0.03	0.07*	0.04
Number of observations	7338	—	6697	641	5467	167	4657	643	5179	2101	2651	427

Note: ^aStandard errors in brackets, with asterisks (*) denote that the differences between NCMS group and other groups are significant at 5% level. ^bSince there is no NCMS in wave 2000, the summaries for NCMS group in 2000 are not available. ^cThe variable 'Any formal medical care in last four weeks' in our analysis is used only in wave 2004 and 2006, thus three related variables 'Any formal medical care in last four weeks', 'Any formal medical care in last four weeks (includes only those who felt sick in last four weeks)', 'Any formal medical care in last four weeks (includes only those whose SRHS is fair or poor in wave 2000)' are not available in wave 2000.

Table AIV. Matching balancing properties between NCMS and control

	Pre-matching				Post-matching (nearest 4 neighbors)				
	(1) Treated	(2) Control	(3) <i>t</i> -stat	(4) <i>p</i> > <i>t</i>	(5) Treated	(6) Control	(7) <i>t</i> -stat	(8) <i>p</i> > <i>t</i>	(9) Bias ^b
<i>Socio-economics</i>									
Log (household income+1)	9.094	8.904	5.19^c	0.000	9.094	9.145	-1.39	0.165	73.1
Primary School ^a	0.227	0.192	2.60	0.009	0.228	0.227	0.06	0.949	97.3
Junior high school	0.267	0.255	0.84	0.400	0.268	0.262	0.38	0.701	50.4
Senior high school and above	0.085	0.081	0.51	0.607	0.085	0.074	1.14	0.256	-135.2
Currently enrolled as a student	0.130	0.137	-0.67	0.503	0.128	0.139	-0.89	0.372	-43.5
Unspecified education level	0.027	0.047	-3.04	0.002	0.027	0.023	0.66	0.511	81.0
<i>Socio-demographics</i>									
Female	0.525	0.531	-0.36	0.716	0.525	0.522	0.15	0.879	54.8
Age	44.247	43.161	1.66	0.097	44.275	44.555	-0.42	0.676	74.2
Married	0.764	0.707	3.87	0.000	0.764	0.758	0.40	0.691	89.3
Single	0.170	0.222	-3.98	0.000	0.169	0.178	-0.65	0.517	83.3
Han (ethnicity)	0.875	0.802	5.95	0.000	0.876	0.901	-2.27	0.023	65.1
<i>Household characteristics</i>									
Family size	3.715	4.069	-6.95	0.000	3.715	3.606	2.12	0.034	69.2
Square of family size	15.924	19.093	-6.75	0.000	15.923	15.019	2.02	0.043	71.5
<i>Province dummies</i>									
Heilongjiang	0.170	0.081	8.39	0.000	0.171	0.190	-1.42	0.157	78.1
Jiangsu	0.144	0.056	9.27	0.000	0.144	0.150	-0.48	0.632	93.1
Shandong	0.132	0.069	6.48	0.000	0.132	0.140	-0.69	0.491	86.5
Henan	0.064	0.187	-11.09	0.000	0.064	0.056	0.86	0.388	94.1
Hubei	0.168	0.054	11.53	0.000	0.168	0.148	1.57	0.117	82.0
Hunan	0.033	0.128	-10.23	0.000	0.033	0.031	0.35	0.723	97.6
Guangxi	0.066	0.208	-12.28	0.000	0.066	0.066	0.05	0.957	99.7
Guizhou	0.066	0.171	-9.61	0.000	0.066	0.076	-1.08	0.282	90.5

^aThe 'Illiterate' group is omitted category for education, 'Other marital status' (divorced or widowed) for marital status and 'Liaoning' for province dummies.

^bBias reduction is the percentage reduction in mean differences between treated and control groups.

^c*t*-Statistics > 1.96 are given in bold.

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